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Prevalence, Risk Factors, and a Cost Benefits Analysis of Early  
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Charlotte Gaydos, Dr. P.H. 9-23-92  
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## INTRODUCTION

Chlamydia trachomatis infections in the U.S. exceed 4 million cases, annually. Since chlamydial infection may initially be asymptomatic in 70% of women, they frequently remain undiagnosed, resulting in acute and chronic sequelae, such as cervicitis, endometritis, pelvic inflammatory disease, ectopic pregnancy, and infertility. In the U.S., the annual costs of chlamydia infections and their sequelae are estimated at \$5 billion. Infection rates for young, sexually active women range from 5-20%, with rates highest for those under 21, suggesting a high prevalence in incoming female recruits. For example, military PID rates are approximately 5 times higher than the national level. However, a comprehensive prevalence study among military women has never been performed.

Since urine samples have now been demonstrated to be excellent specimens for the detection of *C. trachomatis* when tested by the new molecular DNA amplification test, Ligase Chain Reaction (LCR), it is now possible to rapidly, easily, and accurately screen large numbers of patients for chlamydial infection. Our laboratory had extensive experience in the clinical trials evaluating the LCR test and currently performs the assay routinely for up to 800 samples per week.

This grant will implement and evaluate a chlamydia screening program of active-duty female soldiers. Based upon findings of the study, recommendations will be made for an effective, cost-efficient chlamydia control program designed to reduce morbidity due to *C. trachomatis*.

The objectives of this study are to

1. Determine the prevalence of infection in several military female populations;
2. Determine risk factors predictive of infection;
3. Conduct a cost-effectiveness analysis comparing universal screening versus selective screening utilizing risk factor criteria;
4. Recommend a chlamydial control program: selective screening and treatment;) universal screening and treatment; or,) mass therapy for all female basic recruits.

Utilizing ICD codes, we will monitor PID and ectopic pregnancy rates, over the 3 year period of chlamydia screening.

## **BODY**

### **METHODS**

#### **POPULATIONS AND SPECIMENS.**

Three female military populations were studied: Recruits undergoing in processing at the Reception Battalion, Ft. Jackson; Symptomatic active-duty women at the Troop Medical Clinic at Ft. Jackson; and females having a PAP test performed at Ft. Bragg. All participants were voluntarily recruited into the study by a civilian study nurse and have signed a consent form approved by the respective institutional review boards.

Each subject completed a questionnaire for demographic information and sexual risk factor history and provided a urine sample. The questionnaire was a one page, two-sided scannable bubble-form (Scantron Corporation, Tustin, CA). In addition, a endocervical swab for chlamydia culture was obtained by the attending clinician from the volunteers from Ft. Bragg's PAP clinic. Cultures were placed into chlamydia transport medium (2SP). All specimens, consent forms, and questionnaires were shipped to Johns Hopkins University Chlamydia Laboratory, under appropriate environmental conditions (-20° C for urine specimens and on dry ice for the culture specimens).

To determine comparability of the volunteer and non-volunteer recruits at the Reception Battalion, with regard to demographics and risk history, a sub-sample of those non-volunteering recruits were invited to anonymously fill out a questionnaire. This sub-sample was collected on the first Sunday of each month.

#### **CHLAMYDIA TESTS.**

Urines were processed and tested by ligase chain reaction (LCR) [Abbott Labs, Abbott Park, IL] for chlamydial DNA, according to manufacture's directions. The LCR test is now

approved by the FDA for use with both urine and endocervical specimens. The chlamydia cultures were performed in 96-well microtiter plates using McCoy cells, according to standard laboratory procedure.

Discrepant analysis was performed on any discordant sample results from the PAP population at Ft. Bragg. (Discordant defined as either: 1) culture positive/LCR negative; or, 2) culture negative/LCR positive. For the former, LCR was repeated from the stored, frozen aliquot of processed urine, and if still LCR negative, the processed LCR specimen was diluted 1:10 and retested by LCR. In addition, polymerase chain reaction (PCR, Roche Molecular Systems) was performed on a stored frozen aliquot of urine. For the latter, the culture fluid sediment was stained by Direct Fluorescent Antibody (Syva, San Jose, CA) in order to visualize any elementary bodies, characteristic of chlamydia. If positive, this confirmed that the LCR was a true positive test. If the DFA was negative, further testing of the culture fluid by PCR was performed. If the PCR was negative, the LCR was considered to be a false positive test. If the PCR was positive, the LCR result was considered to be a true positive test). The results of these tests were used to determine the sensitivity and specificity of the LCR urine assay as used for this population (PAP).

The scan forms were scanned into a data set (d-base III) and the LCR results, demographics, and risk factor information were analyzed using chi-squared test, Fisher's tests of exactness and logistic regression analysis (Stata, College Station, TX). Data for the multivariate models were recoded as dichotomous variables (presence of risk vs. no risk) according to the findings of the univariate analyses. A cost-effectiveness analysis was conducted using a cost and outcome based decision tree designed in Smltree (Jim Hollenberg, NY 2.9). All consent forms, as well as the original Scantron forms, were stored in a locked file cabinet.

## RESULTS

The following analyses were conducted on cumulative data from January 21, 1996 through June 22, 1997 (see Appendix A for annual break down of data). The exception being the cost-effectiveness analysis which was conducted in March, 1997 for report at the Third Annual Uniformed Services Recruit and Trainee Health Care Symposium: 19-21 May 1997, Walter Reed Army Institute of Research; Washington, D.C. (Appendix B)

**RECRUITS, FT JACKSON:** Of 11,777 recruits presenting at the Physical Exam Station, 9,209 (78.2%) volunteered from January 21 to June 23, 1996. This is a 12 percentage point increase over last year's performance. Seventeen individuals either had unevaluable urine specimen or they were missing more than two data items. Evaluable data from 9,192 recruits showed: 87.2% (8012/9192) were age 25 or younger, 51.9% (4771/9192) were Caucasian, 35.1% (3225/9192) were African American, and 13% (1196/9192) were other races. The prevalence for *C. trachomatis* by urine LCR for the population was 9.0% (828 of 9,192).

By questionnaire, 93.6% (8602/9192) reported having had vaginal sex, 26% (2390/9192) had more than 1 sex partner in the previous 90 days, 30.5% (2806/9192) had a new sex partner in the previous 90 days, and only 15.5% (1429/9192) always used condoms. A prior history of chlamydial infections was reported in 8.8% (806/9192), gonorrhea in 3.2% (291/9192), syphilis in 0.6% (52/9192), and trichomonas infection in 4.5% (415/9192).

By age, prevalences for chlamydia were: 10.95% (age 17-20); 8.01% (age 21-25); 3.14% (age 26-30); and 1.85% (age 31-35). For further analyses, the 2 youngest age categories were combined into a variable called "young" (age 17-25; prevalence 9.9% 793/8012). By race, prevalences were 5.3% for Caucasian, 14.4% for African American, and 9.1% for others.

Univariate analysis identified 5 significant risk factors: young age (17-25 years), African

American, ever having vaginal sex, > 1 sex partner, and new sex partner. Condom use and prior diagnosis of chlamydia, gonorrhea, syphilis, or trichomonas were not significant. In the multivariate model, the variables useful as predictors for chlamydial infection were vaginal sex (OR 4.08, 95% C.I. 2.28-7.29), young age (OR 3.41, 95% C.I. 2.41-4.82), African American (OR 2.71, 95% C.I. 2.34-3.14), more than 1 sex partner (OR 1.41, 95% C.I. 1.17-1.70) and having a new sex partner (OR 1.49, 95% C.I. 1.23-1.79). This population is predominantly young sexually active women. Thus, the population is high risk by definition according to other published studies. If young age alone was used as the screening criteria 87.2% of the population would be tested, including 95.8% of the positives. If sexual activity defined as sexual intercourse was used as the screening criteria 93.6% of the population would be tested, including 98.6% of the positive individuals. Combining these two factors would require screening 99.5% of the population, including 100% of the positives. A truly selective sample of the population would be those with reported high risk behaviors such as more than one sex partner or a new sex partner. However, screening on these criteria alone would require testing 20.1% of the population including only 31.5% of the positives. The cost-effectiveness of these screening strategies will be addressed in the final cost-effectiveness analysis.

**Non-volunteer Recruits, Ft. Jackson:** There were 610 women who filled out a questionnaire, anonymously: very few women had data evaluable for age determination. 33.4% were African American, not significantly different from the volunteers; 3.0% had prior chlamydia, 69.5% had vaginal sex, 17.9% had a new sex partner, and 55.7% did not consistently use condoms(all five characteristics significantly different from those of the volunteers even when vaginal sex was controlled for). 17.9% of the non-volunteers had more than one sex partner in the prior 90 days. This did not differ significantly from the volunteers when vaginal sex was controlled for, however.

**TMC PATIENTS, FT JACKSON:** Volunteers included 672 symptomatic soldiers. The volunteer rate of those approached was 80%. Demographics included: 85% (571/672) were 25 years of age or younger, 51.2% (344/672) were African American. 12.5% (84/672) had a prior history of chlamydia, 96% (645/672) reported vaginal sex, 23.7% (159/672) had a new sex partner in the previous 90 days, 23.1% (155/672) had more than one sex partner in the past 90 days, and 71 % (480/672) did not consistently use condoms.

Prevalences of chlamydia for this symptomatic group of patients were: 11.9% (80/672) overall; 12.8% for  $\leq 25$  yr.; 7.9% for Caucasian; and 15.4% for African American. The prevalence of chlamydia by risk category included: prior chlamydia, 13.1%; vaginal sex, 12.3%; new sex partner, 12%; more than one sex partner in the last 90 days, 13.6%; and inconsistent condom use 11.6%.

**PAP PATIENTS, FT BRAGG:** The volunteer rate approached was 71%. Among 479 asymptomatic volunteers, and one reporting mild symptoms (N=480), demographics included: 55.2% (265/480) were 25 years or younger, 50.8% (244/480) were African American. 17.9% (86/480) had a history of chlamydia, 4.2% (20/480) Gonorrhea, 1.0% (5/480) syphilis, and 8.5% (41/480) trichomonas. 98.3% (472/480) reported vaginal sex, 11.3% (54/480) had a new sex partner in the previous 90 days, 15.2% (73/480) had more than one sex partner in the past 90 days, and 88.5% (425/480) had inconsistent condom use. 30.8% were pregnant.

Fifteen individuals had urine specimen which were missing or unevaluable. Of the remaining 465, the prevalences for chlamydia infection (based on DNA amplification positivity) were: 7.3% (34/465) overall; 11.0% for  $\leq 25$  yr.; and 8.9% for African American and 6.5% for pregnant women. The prevalence of chlamydia by risk category included: prior chlamydial

infection, 3.6%; vaginal sex, 7.4%; new sex partner in the prior 90 days, 15.1%; more than one sex partner in the last 90 days, 10.3%; and inconsistent condom use, 7.5%.

In univariate analysis only young age (OR 4.23, 95% C.I. 1.72-10.43) and new sex partner (OR 2.61 95% C.I. 1.11-6.1) were predictors of chlamydial infection. However, when controlling for age new sex partner was no longer significant.

**Ft. Bragg Population Comparison of urine LCR to cervical culture for C.trachomatis (Asymptomatic Population).**

There were a total 480 women enrolled from the Ft. Bragg asymptomatic population (PAP Clinics) since the beginning of the study. Of these, there were 46 women, who did not have matching specimen results for comparison. The reasons included: 10 tissue culture toxic cervical culture results and 36 for which there was no cervical culture collected or no urine collected. After removal of these non-matched specimens, there were 434 for comparison purposes. See Tables below.

For the 4 specimens that were positive by culture and negative by urine LCR (4), it was considered by convention that culture was 100% specific and that they were true positives. Thus these were false negatives by LCR.

For the 11 specimens that were culture negative and positive by urine LCR (11), it was considered that they may be true positives or false positives. In order to resolve these discrepant results, another method of analysis was used as a "tie-breaker test". It is well known that chlamydia culture is not 100% sensitive.

The first step in this analysis was to sediment the culture transport vial and to perform a direct fluorescent antibody (DFA) stain for chlamydial elementary bodies (EBs). If Ebs were present it was considered that the culture was falsely negative and the positive LCR result was

confirmed as a true positive.

Additional tests were performed to confirm the positive LCR result as a true positive result. These included repeating the urine LCR, performing PCR for chlamydia (Roche Diagnostic Systems, Bromchburg, NJ) and a research PCR (OMP-1 based) for chlamydia on the archived urine specimen, and performing LCR for a different DNA target (OMP-1 gene) on the archived urine specimen. Using these methods of further analysis, all but one positive LCR urine specimen was resolved as a true positive specimen.

		Culture	
		+	-
LCR	+	21	11
	-	4	398

		Infected Status	
		+	-
LCR	+	31	1
	-	4	398

Resolved: Sensitivity      88.6%      Specificity      99.7% Positive

Positive Predictive Value      96.9%      Negative Predictive Value      99.0%

The Ft. Bragg portion of the project is now complete. A manuscript is in progress.

**Cost-effectiveness Analysis: Preliminary Cost-Effectiveness Analysis:** We compared universal screening of all recruits to screening only those recruits under 25 years of age and to provision of azithromycin for all recruits at the PES. We estimated that 50% of women developing symptomatic PID within the first 6 months of service would receive an EPTS discharge.

In an estimated annual recruit population of 13, 236 with a chlamydial prevalence of 9.56%, no screening for *Chlamydia trachomatis* would result in a projected illness cost of \$973,000 over a five year period for treatment of 316 cases of silent and symptomatic pelvic inflammatory disease (PID) and related sequelae (chronic pelvic pain, ectopic pregnancies, and infertility).

Screening only those recruits under the age of 25 would require testing 86% of the population and would identify 95% of the chlamydial infections. This screening strategy would cost approximately \$121,000 in screening and treatment expenditures but would save approximately \$580,000 in future sequelae costs including cost of lost training expenditures due to EPTS discharges. This strategy would prevent 227 cases of silent and symptomatic PID.

Testing all recruits would cost an additional \$17,000 but would prevent 12 more cases of PID than screening only young recruits, saving \$37,000 in sequelae costs, including EPTS losses, for an overall savings of approximately \$20,000 over screening only young recruits.

Mass therapy is the most expensive intervention strategy (approximately \$16 per woman), costing \$70,000 more than universal screening. However, this strategy would prevent 32 additional cases of PID saving \$98,000 in sequelae costs for a total savings of \$28,000 over universal testing.

In the recruit population studied, mass therapy appears to be the cost-effective strategy

relative to no screening, screening only young recruits, or testing all recruits. Mass therapy provides for the prevention of chlamydial sequelae and the associated EPTS discharges. Further analysis is underway.

#### **DISCUSSION IN RELATION TO STATEMENT OF WORK AND PROBLEMS.**

For Year Two, the Statement of Work as stated in the grant included 3 tasks.

**#5. Proposed:** Screening. We will continue to screen approximately 15,000 women by urine LCR at Ft. Jackson to monitor prevalence. Treatment with azithromycin, 1.0 gram dose orally, will be offered to those who are infected with chlamydia.

**Performed:** Recruitment at Ft. Bragg was completed with a total of 480 asymptomatic women enrolling. Collection continues at the PES at Ft. Jackson. A total of 9209 have volunteered. The total enrollment of symptomatic women at Ft. Jackson's TMC is now 672. Chlamydia positive individuals have been notified and treatment has been documented (1.0 gram dose, orally azithromycin).

**Issues:** The departure of a second study nurse necessitated down time to hire and retrain a third nurse. Physical relocation of the clinic resulted in lost collection in February, 1997. Recruitment continued to be difficult; i.e., inconsistent show rates for clinic appointments. A decision was made that sufficient test data had been collected in an asymptomatic population to predict the sensitivity and specificity of the urine LCR as compared to cervical culture.

**#6.. Proposed:** Regression analysis. We will determine by regression analysis which risk factors are predictive of chlamydia infection in each of the above population groups.

**Performed:** The regression analysis for 9,192 female recruits is nearly complete. See Results.

It appeared that young age ( $\leq 25$  yrs.) alone could provide an adequate risk factor upon which to base selective screening; i.e., 87.2% of the population screened would detect 95.8% of positives.

**#7. Proposed:** Cost Analysis. We will determine by cost analysis whether it is more efficient to universally screen and treat, to selectively screen based on risk factors and treat, or to mass treat all female recruits with azithromycin.

**Performed:** Preliminary cost-effectiveness analysis has demonstrated that although mass therapy would appear to be the most expensive intervention strategy, it has the potential to prevent additional cases of PID and other sequelae, providing an overall savings over universal screening in this population.

The decision as to the intervention to be implemented for the 3rd year of collection (January, 1998) is under consideration by our military and civilian collaborators, the Armed Forces Epidemiology Board and the Institutional Review Boards of Johns Hopkins University and Ft. Jackson (Eisenhower, Ft. Gordon).

**Issues:** The final cost-effectiveness analysis is pending with several issues yet to be resolved by a panel of experts and our military and civilian consultants as to Army specific probabilities and costs to be used in the final model. Such unknowns include:

1. Probability of EPTS for discharge due to symptomatic PID;
2. Number of outpatient visits associated with PID;
3. Probability of PID (Army-specific). We have literature reported probability.
4. Probability of Azythromycin associated side effects/cost in military recruits.

We only have literature reported data.

5. No Army-specific cost of chronic pelvic pain and ectopic pregnancy.

These issues are under consideration by our panel as mentioned above in order to decide whether to use data available from civilian sources or to ascertain military specific data, if possible.

## CONCLUSIONS

Urine-based screening for *C. trachomatis* by Ligase Chain Reaction was effective in a female military recruit population, as well as in a symptomatic Troop Medical Clinic population and an asymptomatic PAP clinic population. Acceptance was high, the urine specimens were readily obtained, and the assays were able to be performed quickly and efficiently.

The study has demonstrated a high prevalence (9.0%) for female recruits from a geographically and demographically diverse group, a substantial prevalence (11.9%) from a symptomatic Troop Medical Clinic population, and a higher than expected prevalence (7.3%) from an asymptomatic PAP clinic population. These results have indicated the need for an ongoing chlamydial control program in such female military groups.

Among recruits, risk factor analysis by multivariate logistic regression identified five independent, statistically significant, predictors for being infected with chlamydia: young age, African American, vaginal intercourse, more than one new sex partner, and a new sex partner in the prior 90 days. Women that volunteered from the recruit population appeared to have behavioral characteristics that put them at high risk for chlamydial infections. Women, who were non-volunteers appeared to be similar demographically and many also practiced high risk behavior, but were significantly less likely to have these risk factors (prior chlamydia infection, vaginal sex, new sex partner, more than one sex partner, and inconsistent condom use) than were the volunteers.

Although the women from the symptomatic (TMC) and asymptomatic (PAP) groups had prevalences that were higher than the recruit population, their demographic and risk factor profiles were similar. The numbers of women enrolled at the present time are insufficient to perform univariate or multivariate regression analyses.

A chlamydial screening program that focused on screening all young female recruits (age 25 or less) would require that 87.2% of this population would be screened and 95.8% of all positive infections would be identified. Such a screening program as this, which employed urine LCR testing, has the potential to prevent pelvic inflammatory disease and ectopic pregnancy in Army women.

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## **APPENDIX A**

**Table 1. Characteristics of Military Women Screened for *Chlamydia trachomatis* at Fort Jackson (PES) Recruits: (n = 9,192)**

<b>Variables</b>	<b>No.</b>	<b>%</b>
<b>Mean Age, years (range)</b>	22	(17 - 40)
<b>Ethnicity</b>		
White	4,771	51.9
African American	3,225	35.1
Other (American Indian, Alaskan, Asian Pacific)	1,196	13.0
<b>Military Category</b>		
Enlisted	9,187	99.9
Officer	5	.05
<b>Having had vaginal sex</b>	8,602	93.6
<b>Sexual History (past 90 days)</b>		
More than one sex partner	2,390	26
New sex partner	2,806	30.5
Consistent condom use	1,429	15.5
Inconsistent condom use	7,289	79.3
<b>Previous Diagnosis</b>		
<i>Neisseria gonorrhoeae</i>	291	3.2
<i>Chlamydia trachomatis</i>	806	8.8
Syphilis	52	.6
Trichomonas	415	4.5
None	7,943	86.4
<b>Chlamydia Positive LCR</b>	828	9.0

**Table 2. Characteristics of Volunteers and Non-Volunteers Fort Jackson Recruits**

	<b>Volunteers (n = 9192)</b>	<b>Non-Volunteers (n = 610)</b>
<b>Age</b>		
<b>Race, %</b>		
White	51.90	49.18
Black	35.08	33.44
American Indian/Alaskan	1.16	1.15
Asian/Pacific	2.45	2.95
Other*	9.40	13.28
<b>Ever having had vaginal sex*</b>	93.58	69.51
<b>New sex partner, last 90 days s†</b>	30.53	17.87
<b>More than one sex partner, last 90 day‡</b>	26.0	17.87
<b>Condom use with every sex act, last 90 days**</b>	15.55	21.48
<b>Previous STD</b>		
chlamydia††	8.77	2.95
gonorrhea‡‡	3.17	1.15
syphilis	.57	.66
trichomonas***	4.51	1.97
none †††	86.41	87.38

\* P = .004

\* P ≤ .000

† P ≤ .000, P = .001 when control for vaginal sex

‡ P = .001, P = .164 when control for vaginal sex

\*\* P ≤ .000, P ≤ .000 when control for vaginal sex

†† P ≤ .000, P ≤ .000 when control for vaginal sex

‡‡ P = .007, P = .049 when control for vaginal sex

\*\*\* P = .004, P = .062 when control for vaginal sex

††† P = .500, P = .043 when control for vaginal sex

**Table 3. Univariate Analysis: Factors Associated with Chlamydial Infection Fort Jackson Recruits:**

Factor*	% Risk of Infection		Odds Ratio (95% C.I.)
	Factor Absent	Factor Present	
Age $\leq$ 25 (8,012)	2.97	9.90	3.6 (2.55, 5.07)
Black race (3,225)	6.10	14.39	2.6 (2.24, 2.99)
Having ever had vaginal sex (8,602)	2.03	9.49	5.1 (2.84, 8.72)
Having had $\geq$ 1 sex partner, last 90 days (2,390)	7.42	13.51	1.95 (1.68, 2.35)
Having had a new sex partner, last 90 days (2,806)	7.36	12.76	1.8 (1.59, 2.13)

Note.  $P \leq .000$

\*numbers in parentheses indicate the number of women for whom the factor was present

**Table 4. Factors Associated Independently with Chlamydial Infection Fort Jackson Recruits:**

<b>Factor</b>	<b>Beta Coefficient</b>	<b>Odds Ratio (95% C.I.)</b>
<b>Constant</b>	-1.12	...
<b>Age <math>\leq</math> 25</b>	-1.23	3.4 (2.41, 4.82)
<b>Black race</b>	-.998	2.7 (2.34, 3.14)
<b>Having ever had vaginal sex</b>	-1.41	4.1 (2.28, 7.29)
<b>Having had <math>\geq</math> 1 sex partner, last 90 days</b>	-.343	1.4 (1.17, 1.70)
<b>Having had a new sex partner, last 90 days</b>	.397	1.5 (1.23, 1.79)

*Note.*  $P \leq .000$

**Table 5. Strategies for Selective Testing for Chlamydial Infection Fort Jackson Recruits**

Strategy	Risk Factor	Sensitivity %	Specificity %	% Identified as Higher Risk	Positive Predictive Value, %	1-Negative Predictive Value, %	Cases Missed
A	Y,B,V,N,M*	100	.32	99.7	9.03	0	0
B	Y,V	100	.5	99.5	9.05	0	0
C	Y,B,N,M	99.3	6.85	93.68	9.52	1.38	8
D	Y,B,N	99.3	7.35	93.22	9.57	1.28	8
E	Y,B,M	98.9	7.41	93.16	9.56	1.43	9
F	V	98.6	6.91	93.58	9.49	2.03	12
G	Y,B	98.4	9.04	91.63	9.68	1.69	13
H	Y	95.8	13.69	87.16	9.90	2.97	35

\*Y= young age, B= Black, V= vaginal sex, N=newsex partner, M=more than 1 sex partner

**Table 6. Characteristics of Military Women Screened for *Chlamydia trachomatis* at Fort Jackson (TMC) (n = 672)**

Variables	No.	%
Median Age, years (range)	22	(18-46)
<b>Ethnicity<sup>†</sup></b>		
White	267	39.7
African American	344	51.2
Other (American Indian, Alaskan, Asian Pacific)	58	8.6
<b>Military Category<sup>**</sup></b>		
Enlisted	667	99.3
Officer	4	.6
<b>Reason for Test</b>		
Sex partner of infected individual	3	.45
Complaint of symptoms	2	.3
Screening	669	99.6
Other	0	
<b>Clinical Presentation<sup>***</sup></b>		
Mucopus	91	13.5
Cervicitis	56	8.3
Ectopy	14	2.1
Cervical motion tenderness	12	1.8
Friability	12	1.8
Pregnant	25	3.7
Normal exam	23	34.7
<b>Sexual History (past 90 days)</b>		
More than one sex partner	155	23.1
New sex partner	159	23.7
Consistent condom use	192	28.6
Inconsistent condom use	480	71.4
<b>Previous Diagnosis</b>		
<i>Neisseria gonorrhoeae</i>	30	4.5
<i>Chlamydia trachomatis</i>	84	12.5
Syphilis	3	.45
Trichomonas	84	12.5
None	506	75.3
<b>Chlamydia Positive LCR</b>	80	11.9

<sup>†</sup> Data missing from three women (.45%).

<sup>\*\*\*</sup> Data missing from forty-seven women (7.0%).

Table 7. Characteristics of Military Women Screened for *Chlamydia trachomatis* at Fort Bragg, SC (n = 480)

Variables	No.	%
Median Age, years (range) <sup>*</sup>	25	(19-47)
Ethnicity <sup>†</sup>		
White	181	37.7
African American	244	50.8
Other (American Indian, Alaskan, Asian Pacific)	52	10.8
Military Category <sup>**</sup>		
Enlisted	439	91.5
Officer	36	7.5
Reason for Test <sup>‡</sup>		
Sex partner of infected individual	1	.2
Complaint of symptoms	1	.2
Screening	470	97.8
Other	4	.8
Clinical Presentation <sup>***</sup>		
Mucopus	1	.2
Cervicitis	5	1.0
Ectopy	5	1.0
Cervical motion tenderness	3	.6
Friability	39	8.1
Pregnant	148	30.8
Normal exam	348	72.5
Sexual History (past 90 days)		
More than one sex partner	73	15.2
New sex partner	54	11.3
Consistent condom use	51	10.6
Inconsistent condom use	425	88.5
Previous Diagnosis <sup>††</sup>		
<i>Neisseria gonorrhoeae</i>	20	4.2
<i>Chlamydia trachomatis</i>	86	17.9
Syphilis	5	1.0
Trichomonas	41	8.5
None	348	72.5
Chlamydia Positive LCR	34	7.1
Chlamydia Positive Culture	24	5.0

\* Data missing from eight women (1.7%).

† Data missing from three women (.6%).

\*\* Data missing from five women (1.0%).

‡ Data missing from five women (1.0%).

\*\*\* Data missing from twenty-seven women (5.6%).

†† Data missing from two women (.4%).

**Table 8. Univariate Analysis: Factors Associated with Chlamydial Infection Fort Bragg, Patients**

Factor <sup>a</sup>	% Risk of Infection		Odds Ratio (95% C.I.)
	Factor Absent	Factor Present	
Age ≤ 25 (254)	2.8	11.0	4.2 (1.72, 10.43)
Having had a new sex partner, last 90 days (53) <sup>*</sup>	6.8	15.1	2.6 (1.11, 6.10)

Note. P ≤ .05

<sup>a</sup>numbers in parentheses indicate the number of women for whom the factor was present

<sup>\*</sup>newsex is not significant when controlled for age.

## APPENDIX B

# Chlamydia Screening by Risk Factor in Female Recruits n = 9,192

Strategy	Young	Afr.-Amer.	Vag.	New Sex	>1 Sex Pt.	% to Screen	% Positives Identified
I	x	x	x	x	x	99.7	100
II	x		x			99.5	100
III	x	x		x	x	93.7	99
IV	x	x		x		93.2	99
V	x	x			x	93.2	98.9
VI	x	x				91.6	98.4
VII	x					87.2	95.8

# Recruit Population

## Multivariate Analysis n = 9,192

Variable	O.R.	95% C.I.
< 25 years of age	3.4	(2.41-4.82)
African American	2.7	(2.34-3.14)
Vaginal Sex	4.1	(2.28-7.29)
New Sex Partner	1.5	(1.23-1.78)
> 1 Sex Partner	1.4	(1.17-1.70)

# Urine LCR Sensitivity and Specificity Compared to Cervical Culture Asymptomatic Population (PAP Clinic) N = 434\*

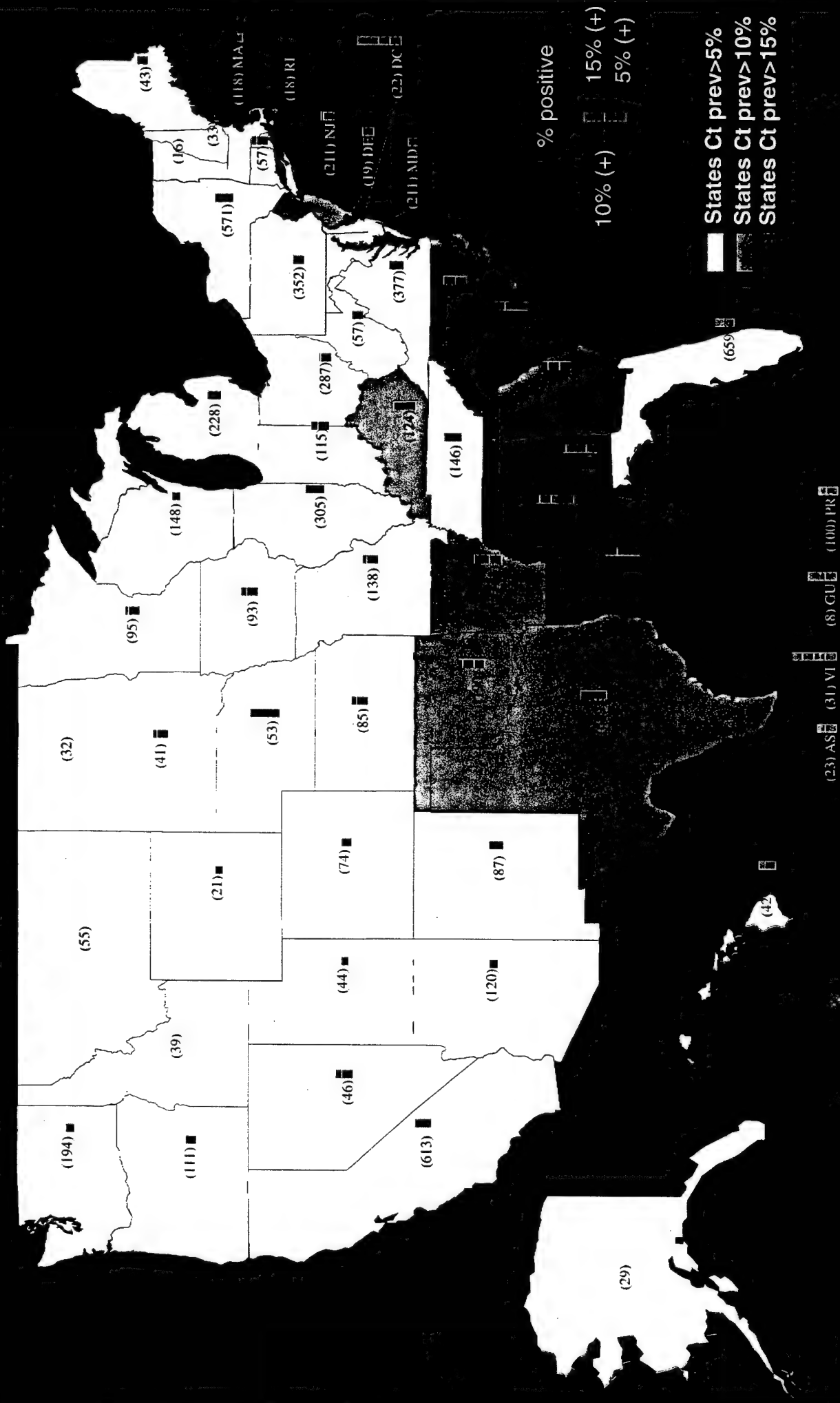
Culture		Infected Status**	
LCR	+	-	+
	21	11	31
-	4	398	4
			398
Resolved		Sens 88.6%	PPV 96.9%
		Spec 99.7%	NPV 99.0%

\*480 women enrolled--46 w/o matching specimens = 434

\*\* Resolved by DFA, PCR (OMP-1, plasmid genes), LCR OMP-1

# State of Origin: New Army Recruit % Ct Positive (n=9,209)

(# of women coming from each state)



## APPENDIX C

3RD ANNUAL

Uniformed Services

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RECRUIT & TRAINEE  
HEALTH CARE

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Symposium

AGENDA

*"Reducing Attrition,  
Promoting Health"*

STERNBERG  
AUDITORIUM  
(WRAIR BUILDING)

Walter Reed Army  
Institute of Research  
Washington, DC

May 19-21  
1997

## HEALTH PROMOTION SECTION

- 1300-1330 **Nutrition for Performance/Power Performance Video**  
MAJ Ann Grediagin, MS, USA  
Directorate of Health Promotion and Wellness  
USACHPPM, Aberdeen Proving Ground, MD
- 1330-1350 **"Recruit Tobacco Cessation Counseling Project"**  
LT David P. Murphy, MC, USN  
Recruit Medicine Clinic, Naval Hospital, Great Lakes, IL
- 1350-1410 **"Recruit Dermatology Screening and Education Project"**  
ENS Gregory D. Buttolph, MSC, USN  
Physician Assistant, Naval Hospital, Great Lakes, IL
- 1410-1430 **Oral Health of U.S. Military Recruits**  
LTC Michael C. Chisick, DC, USA  
Directorate of Health Promotion and Wellness  
USACHPPM, Aberdeen Proving Ground, MD
- 1430-1500 **Break (Exhibit Area Outside Sternberg Auditorium)**
- 1500-1520 **Evaluating Auditory Readiness in the Recruit Population:  
Ensuring a Fighting Force for Tomorrow**  
LCDR Anne R. Shields, MS, USN  
MAJ Kathryn E. Gates, MS, USA  
Hearing Conservation, Directorate of Clin. Prev. Med.  
USACHPPM, Aberdeen Proving Ground, MD
- 1520-1540 **Vision Conservation in Recruits**  
LCDR Lee L. Cornforth, MSC, USN  
Vision Conservation, Directorate of Clin. Prev. Med.  
USACHPPM, Aberdeen Proving Ground, MD
- 1540-1600 **What Is Health Promotion and Why Is It Important for  
Readness?**  
Ms. Judy Harris  
Directorate of Health Promotion and Wellness  
USACHPPM, Aberdeen Proving Ground, MD
- 1600-1620 **Health Promotion Panel Discussion**  
(Above Speakers) Moderator: LTC (P) Joan Eitzen, ANC, USA
- 1620-1700 **Poster Session Awards, Concluding Remarks**
- 1700 **Retirement of Colors**

*Division of Preventive Medicine Walter Reed Army Institute of Research Washington DC*

## PHYSICAL FITNESS AND INJURY SECTION

- 1315-1335 Recruit Physical Fitness, Training and Injuries In the 80s and 90s  
COL Bruce Jones, MC, USA  
Director, Epidemiology and Disease Surveillance  
USACHPPM, Aberdeen Proving Ground, MD
- 1335-1355 The Fort Leonard Wood Recruit Injury Study  
MAJ Leo Mahony, MS, USA  
Directorate of Health Promotion and Wellness  
USACHPPM, Aberdeen Proving Ground, MD
- 1355-1415 BREAK (exhibit area outside Sternberg Auditorium)
- 1415-1425 The Fitness Training Company at Fort Jackson, SC  
CPT Paul Stoneman, SP, USA  
Company Commander, Fitness Training Co. 120th AG Bn  
Fort Jackson, SC
- 1425-1445 Stress Fractures In Marine Corps Females  
CAPT Ken Long, MC, USN  
Senior Medical Officer, Branch Medical Clinic  
Parris Island, South Carolina
- 1445-1505 Stress Fracture Rehabilitation Challenges and Outcomes  
at the Navy's Recruit Training Command, Illinois  
LCDR Scott R. Johnson, MSC, USN  
Naval Hospital, Great Lakes, Illinois
- 1505-1525 The Fort Benning Injury EPICON Study  
MAJ William C. Hewitson, MC, USA  
Ms. Michelle L. Canham  
Directorate of Epidemiology and Disease Control  
USACHPPM, Aberdeen Proving Ground, MD
- 1525-1600 Physical Fitness and Injury Panel Discussion  
(Above Speakers)  
Moderator: COL Bruce H. Jones MC, USA
- 1600-1700 Poster Session #2 (3rd Floor WRAIR)(Judging)

## Wednesday, May 21

0730-0800 Continental Breakfast (WRAIR)

### ADHD AND BEHAVIORAL HEALTH SECTION

- 0800-0820 "Im Golving to Kill Myself If You Don't Let Me Out of th Army"  
MAJ E. Cameron Ritchie, MC, USA  
Department of Psychiatry  
Walter Reed Army Medical Center, Washington, DC
- 1080-0900 What do You do with recruits who have a history of ADHD?  
CAPT Warren A. Jones, MC, USA  
Director, Physical Qualifications and Review  
Bureau of Medicine & Surgery, Washington, DC
- 0900-0920 The Mental Health Emergency Room at Air Force Basic Training  
MAJ (sel) Jeff Cigrag BSC, USAF  
Chief, Behavioral Analysis Service  
59th Medical Wing, Lackland, AFB, TX
- 0920-0945 Break (Exhibit Area Outside Sternberg Auditorium)
- 0945-1005 Psychological Services for the Recruit Convalescent Unit  
Dr. Carolyn F. Andrews, Clinical Psychologist  
Recruit Evaluation Unit, Naval Hospital, Great Lakes, IL
- 1005-1025 Sexual Harassment/Sexual Misconduct at Basic Training Bases  
COL John A. Fulmer,, AG, USA  
Deputy Commander of Personnel,  
U.S. Army Training and Doctrine Command, Fort Monroe, VA
- 1025-1130 ADHD and Behavioral Health Panel Discussion  
(Above Speakers)  
Moderator: CDR Larry K. Grubb, MC, USN
- 1130-1300 Lunch

1615-1630	Cost Effectiveness Analysis of PAP Smear Screening at Basic Training CAPT Ken Long MC, USN Senior Medical Officer, Branch Medical Clinic Parris Island, South Carolina	0840-0905	"Sexual Risk Behaviors of Recruits at Fort Jackson, S.C." LTC (P) Joan Eitzen ANC, USA USACHPPM, Aberdeen Proving Ground, MD
1630-1700	Exercise Related Mortality in Recruit Basic Training COL John W. Gardner MC, USA Professor of Epidemiology USUHS, Bethesda, Maryland	0905-0930	"Serum Titer Directed Immunization" LCDR Margaret A.K. Ryan MC, USA Head, Division of Preventive Medicine Naval Hospital, Great Lakes, Illinois
1800	Buses depart to the Navy Officers' Club for dinner	0930-0945	BREAK (exhibit area outside Sternberg Auditorium)
1830-2000	Dinner at Navy Officers' Club  Special Awards for the Developers of the Adenovirus Vaccines:  Dr. Robert M. Chanock Dr. Harold S. Ginsberg Dr. Robert Couch MG (Ret.) Philip K. Russell MC, USA COL (Ret.) Franklin H. Top MC, USA COL (Ret.) Edward L. Buescher Jr., MC, USA  Presentation of Awards by: COL Joel C. Gaydos MC, USA  Reducing Attrition, Promoting Health: An Historian's View" Special Guest Speaker: Dr. Dale C. Smith, USUHS	0945-1015	Booster Phenomenon Associated with Sequential Tuberculin Skin Testing in Marine Recruits CDR Edward Gastaldo MC, USN Medical Epidemiologist, Beaufort, SC
		1015-1045	"Respiratory Disease Control in Military Basic Training Camps" CAPT (sel.) Greg Gray, MC, USN Naval Health Research Center, San Diego, CA
		1045-1055	"National Military Invasive Streptococcus pyogenes Surveillance" Mr. Tony Hawksworth, Naval Health Research Center San Diego, CA
		1055-1105	"National Military Adenovirus Surveillance" Dr. Pulak Goswami, Naval Health Research Center San Diego, CA
		1105-1140	"Adenovirus: A Past and Present Treat" COL Joel C. Gaydos, MS, USA Director, Clinical Preventive Medicine USACHPPM, Aberdeen Proving Ground, MD
0730-0800	Continental Breakfast (WRAIR)	1140-1200	Infectious Disease Panel Discussion (Above Speakers) Moderator: CAPT Jon D. Bayer MC, USN
0800-0840	★ <b>INFECTIOUS DISEASE SECTION</b> "Chlamydia Screening in Recruits" Dr. Charlotte Gaydos, Assistant Professor, Infectious Disease Division, School of Medicine, Johns Hopkins University, Baltimore, MD	1200-1315	Lunch (box lunches/poster session #1/3rd Floor, WRAIR)

Tuesday, May 20

## Sunday, May 18

1800-2000      Registration; Mologne House  
Walter Reed Army Medical Center

## Monday, May 19

0700-0800      Breakfast and Registration; Sternberg Auditorium  
Walter Reed Army Institute of Research (WRAIR)

0800-0815      Posting of the Colors/Service Songs

0815-0830      Welcome from the U.S. Army Center for Health Promotion  
and Preventive Medicine (USACHPPM)

BG Patrick D. Sculley, USA Commander  
USACHPPM, Aberdeen Proving Ground, Maryland

0830-0850      Overview of Symposium/Administrative Information  
LTC (P) Patrick W. Kelley MC, USA  
Director, Division of Preventive Medicine  
WRAIR, Washington DC

LTC Ralph Loren Erickson MC, USA  
Program Manager, Professional Medical Education  
USACHPPM, Aberdeen Proving Ground, Maryland

0850-0920      The Personnel Costs of Attrition  
LTG Normand G. Lezy, USAF  
Deputy Assistant Secretary of Defense for Military  
Personnel Policy, Pentagon, Washington DC

0920-0940      The Navy's Perspective on Attrition  
RADM Kevin P. Green, USN  
Commander, Naval Training Center  
Great Lakes, Illinois

0940-1000      Break (Exhibit area-Sternberg Auditorium)

1000-1020      The MEPCOM Perspective on Attrition  
COL Lawrence J. Feters MC, USA  
Command Surgeon  
USAMEPCOM, N. Chicago, Illinois

1020-1110

Attrition at a U.S. Army Training Center  
MG William J. Bolt, USA  
Commanding General  
Fort Jackson, South Carolina

COL Dale Carroll MC, USA  
Commander  
USAMEDDAC, Fort Jackson, South Carolina

1110-1200

Attrition at the Coast Guard's Basic Training Base  
LCDR Michael McCloughan, CG  
Director of Training  
Cape May, New Jersey

LCDR Maura Dollymor, PHS  
Director of Health Services  
Cape May, New Jersey

1200-1330

Lunch (Local)

1330-1400

The Health Affairs Perspective of Attrition/  
The Need for Objective Measures  
Dr. John F. Mazzuchi  
Deputy Secretary of Defense for Clinical Services  
Pentagon, Washington, DC

1400-1430

Accession Medical Standards/Introduction to the AMSARA  
LTC (P) Patrick Kelley MC, USA  
Director, Division of Preventive Medicine, WRAIR,  
Washington, DC

1430-1500

The Accession Asthma Standard  
CPT Kathryn L. Clark MC, USA  
Division of Preventive Medicine, WRAIR,  
Washington, DC

1500-1530

Break (Exhibit area-Sternberg Auditorium)

1530-1615

Medical Accession Standards Panel Discussion  
(Members of the DoD Working Group)  
Moderator: COL Thomas E. Baldwin MC, USAF

Use of Urine Ligase Chain Reaction (LCR) to diagnose *C. trachomatis* in female soldiers at Ft. Jackson and Ft. Bragg.

C.A. Gaydos, D. Pham, M.R. Howell, B. Pare, D. Ellis, K. Clark, K. McKee, R. Hendrix, J. Gaydos, T.C. Quinn, Johns Hopkins Univ, Balt. MD. Ft. Jackson, SC, Ft Bragg, NC, CHPPM, Aberdeen, MD, NIH, NIAD, Bethesda, MD.

This ongoing study used urine LCR to determine the prevalence of and risk factors for chlamydial infections among military females. Three different populations were screened: recruits who were beginning military service, symptomatic patients attending a Troop Medical Clinic (TMC), and asymptomatic women having a PAP test. Each soldier provided a urine and answered a questionnaire. Urines were tested by LCR (Abbott Labs) and the PAP patients were also tested by cervical culture. In 5,096 women screened, the prevalence was 8.6%. The recruits, TMC, and PAP populations had prevalences of 8.2%, 12.1%, and 7.1%, respectively. The mean age was 22; 50.5% were Caucasian; 23.9% had more than 1 sex partner in the last 90 days; and 26.3% had a new sex partner. Only 17.1% used condoms consistently; 9.7% had a chlamydial infection previously. Univariate analysis identified several risk factors useful for predicting chlamydial positivity: young age, African-American race, more than 1 sex partner, and a new partner. Urine-based screening was effective in screening large numbers of women and was highly acceptable. Compared to culture, the sensitivity of LCR was 88.2% in the asymptomatic group. A universal or targeted screening program is being developed and should prevent acute chlamydial morbidity and sequelae such as PID.

Presented at the American Society of Microbiology; Miami, Florida; 5/97.  
Abstract #C-377

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COST-EFFECTIVENESS OF SCREENING vs MASS THERAPY  
FOR *C. TRACHOMATIS* IN FEMALE ARMY RECRUITS

Howell MR<sup>1</sup>, McKee K<sup>2</sup>, Ellis D<sup>3</sup>, Gaydos J<sup>4</sup>, Hendrix R<sup>2</sup>, Quinn TC<sup>1,5</sup>, Gaydos CA<sup>1</sup>  
<sup>1</sup>The Johns Hopkins University, Baltimore, MD; <sup>2</sup>Fort Bragg, NC; <sup>3</sup>Fort Jackson, SC;  
<sup>4</sup>CHPPM, Aberdeen Proving Ground, MD; <sup>5</sup>NIAID, NIH, Bethesda, MD.

**Objective:** In US Army women *C. trachomatis* (CT) may cause a significant degree of morbidity. We sought to assess the relative cost-effectiveness of three screening and treatment strategies for CT in a military setting.

**Methods:** We compared universal and targeted screening to mass therapy with azithromycin for CT in female recruits using a cost-effectiveness analysis. At Fort Jackson, SC 7,191 recruits presenting for basic training from 1/96-3/97 were tested by urine LCR for CT. In a decision model from a military perspective, we assessed the total costs (program, medical, and military) and the level of prevented disease due to CT (PID, chronic pelvic pain, and ectopic pregnancy) associated with each of the 3 strategies. Results were extrapolated to an annual cohort of 13,236 recruits.

**Results:** The recruit sample had a CT prevalence of 9.56% and a diverse ethnic and geographical background. Approximately 86% were  $\leq 25$  yrs old.

Strategy n = 13,236	Projected Costs (US\$1995)		Projected PID (#) (silent & symptomatic)
	Program	Sequelae	
No Intervention	-----	\$973,100	316
Screen $\leq 25$ yrs & Treat (+)	\$120,600	\$273,000	89
Screen All & Treat (+)	\$137,900	\$236,400	77
Mass Therapy	\$207,400	\$138,600	45

Mass therapy dominated both screening strategies, costing ~\$16/woman and saving \$627,100 over a projected 5 year period (8.2% and 4.9% more than targeted and universal screening, respectively).

**Conclusion:** Mass therapy in a well defined cohort of young women with a high prevalence of CT would prevent sequelae, would likely decrease the number of discharges for medical reasons in the first 6 mos. of service, and would save overall costs.

**Part 5.** The author affirms that the material submitted has not been previously published or presented at any national or international meeting; any experimentation has been conducted according to a protocol approved by the institution, committee on human research or, if no such committee exists, by one which conforms with the principles of the Declaration of Helsinki of the World Medical Association (Clinical Research 14: 193, 1966). The undersigned also certifies that all authors named in the abstract have agreed to its submission for presentation at the International Congress of Sexually Transmitted Diseases, October 19-22, 1997.

Author signature

Date

3/27/97

Accepted for presentation at the International Society of  
Sexually Transmitted Disease Research Conference; Seville,  
Spain; October, 1997